UNITED STATES PATENT AND TRADEMARK OFFICE

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| 10/568,940 | 02/21/2006 | David S. Frankel | 2003UR034 | 3591 |

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| EXAMINER |
|---|
| CRAIG, DWIN M |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| | Application No. | Applicant(s) |
| :--- | :--- | :--- |
| | 10/568,940 | FRANKEL, DAVID S. |
| **Office Action Summary** | Examiner | Art Unit |
| | DWIN M. CRAIG | 2123 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on <u>21 February 2006</u>.
2a)☐ This action is **FINAL**.      2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) <u>1-41</u> is/are pending in the application.
     4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) <u>1-41</u> is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.
10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
     a)☐ All   b)☐ Some * c)☐ None of:
       1.☐ Certified copies of the priority documents have been received.
       2.☐ Certified copies of the priority documents have been received in Application No. _____.
       3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
     * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
     Paper No(s)/Mail Date <u>2/21/2006, 3/30/2006, 5/19/2006</u>.

4) ☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

1.      Claims 1-41 have been presented for Examination.

### *Claim Rejections - 35 USC § 101*

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2.      Claims 1-41 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

2.1      Claims 1-41 are rejected under 35 U.S.C. § 101 because the claimed subject matter amounts to a claim to a mathematical algorithm and further to a method of manipulating an abstract construct, in this case a model used to simulate the flow of fluid through a porous media. Section 2106.02 states:

"If the "acts" of a claimed process manipulate only numbers, *abstract concepts* or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter. Gottschalk v. Benson, 409 U.S. 63, 71 - 72, 175 USPQ 673, 676 (1972). Thus, a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process." *Emphasis added.*

The claims in the instant case teach manipulation of a set of vertices, which teach manipulations of abstract constructs, *in this case vertices*, further Applicant's are expressly claiming an algorithm, see claim 2, *A method according to claim 1, wherein said single-source shortest paths algorithm is based upon Dijkstra's single-source shortest-paths* <u>*algorithm.*</u>

**2.2**     Claims 1-31 are further rejected under 35 U.S.C. § 101 because all process claims **_must_**

(1) be _"tied"_ to another statutory class (such as a particular apparatus) or (2) transform

underlying subject matter (such as article or materials) to a different state or thing.

### Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on
sale in this country, more than one year prior to the date of application for patent in the United States.

**3.**     Claims 1, 2, 32 and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by

"Greed: Shortest Path" by Kevin Wayne, hereafter referred to as _Wayne_.

**3.1**     As regards independent claims 1 and 32 and using claim 1 as an example, _Wayne_

discloses,  _a method of evaluating the transmission of a property within a subsurface geologic_

_reservoir, comprising: a) providing a set of vertices representative of at least a portion of said_

_reservoir; b) providing a plurality of edges, said edges representing property transmission paths_

_between connected vertices within said set of vertices; c) associating with each edge a cost_

_representative of the ability of said property to be transmitted across said edge from one vertex_

_to another vertex within said set of vertices; d) selecting at least one source vertex from within_

_said set of vertices; and e) determining an extremum path between said source vertex and each_

_of at least two destination vertices that minimizes or maximizes a summed cost across the one or_

_more edges included in said extremum path using a graph-theory single-source shortest-paths_

_algorithm._ See pages 1-10.

**3.2**      As regards claims 2 and 33 and using claim 2 as an example, *Wayne* discloses, *wherein*

*said single-source shortest-paths algorithm is based upon Dijkstra's single-source shortest-paths*

*algorithm* (page 8).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains.  Patentability shall not be negatived by the
> manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1.      Determining the scope and contents of the prior art.
2.      Ascertaining the differences between the prior art and the claims at issue.
3.      Resolving the level of ordinary skill in the pertinent art.
4.      Considering objective evidence present in the application indicating obviousness
        or nonobviousness.

**4.**      Claims 3-31 and 34-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over

*Wayne* in view of U.S. Patent 6,106,561 to Farmer.

**4.1**      As regards claim 3, *Wayne* does not expressly disclose, wherein said subsurface geologic

reservoir contains a fluid and said property is a property of said fluid, said subsurface geologic

reservoir, or a combination thereof.

However, *Farmer* clearly teaches modeling and simulation of *fluid flow in a subsurface*

*reservoir* (Figure 16 and Col. 26 lines 63-67 and Col. 27 lines 1-19 more specifically, "...fluid

flow...").

*Wayne* and *Farmer* are analogous art because they both come from the same problem solving area of modeling fluid flow.

At the time of the invention, it would have been obvious to an artisan of ordinary skill to have used the Dijkstra's single-source shortest-paths algorithm teachings of *Wayne* with the fluid flow simulation teachings of *Farmer*.

The motivation for doing so would have been, to provide a more accurate earth formation grid block property information, see *Farmer* Col. 1 lines 36-49.

Therefore it would have been obvious to combine the teachings of *Farmer* with *Wayne* to obtain the invention as specified in claims 3-31 and 34-41.

**4.2**     As regards claim 4, *Wayne* teaches, wherein said cost is selected from a measure representative of resistance to fluid flow (page 4 "arc cost").

**4.3**     As regards claims 5 and 6 and using claim 5 as an example, *Wayne* does not expressly disclose, wherein said cost is selected from a value calculated from transmissibility, phase potential difference and phase mobility, however, *Farmer* teaches, (Figure 39 and Col. 16 lines 16-53 see the discussion regarding "transmissibility").

**4.4**     As regards claim 7, *Wayne* teaches cost, see page 4 however *Wayne* does not expressly disclose, transmissibility. *Farmer* teaches (Figure 39 and Col. 16 lines 16-53 see the discussion regarding "transmissibility").

**4.5**     As regards claim 8, *Wayne* discloses vertices, see page 2, however, *Wayne* does not expressly disclose, *cells*. *Farmer* teaches the use of cells, see Col. 16 lines 16-53 and Figure 32.

**4.6**     As regards claim 9, *Wayne* teaches wherein said step of providing a plurality of edges

includes providing a plurality of connections and translating said connections into edges, see

page 2.

**4.7**     As regards claim 10, *Wayne* teaches, wherein said steps of providing a set of vertices and

providing a plurality of edges, see page 2, however, *Wayne* does not expressly disclose,

discretizing a subsurface geologic reservoir into said cells and said connections. *Farmer* teaches,

cells to model a subsurface geologic reservoir, see Col. 16 lines 16-53 and Figure 32.

**4.8**     As regards claim 11, *Wayne* does not expressly teach wherein said cells are part of a 3D

geologic model, however, *Farmer* teaches, Figure 13d2.

**4.9**     As regards claim 12, *Wayne* teaches, wherein said translating said connections into edges

includes comparing said connections with a criterion and forming edges from only those

connections which meet said criterion, see page(s) 5, 6 & 7.

**4.10**    As regards claim 13, *Wayne* does not expressly teach further comprising displaying at

least one of said extremum paths, at least one vertex, or at least one edge on a graphical device

but *Wayne* does teach extremum paths with at least one vertex, see page(s) 5, 6 & 7. However,

*Farmer* teaches displaying on a graphical device Figure 13c2 item 40c1N.

**4.11**    As regards claim 14, *Wayne* does not expressly disclose wherein said graphical device

comprises a 3D viewer. However, *Farmer* teaches displaying on a graphical device Figure 13c2

item 40c1N.

**4.12**    As regards claim 15, *Wayne* does not expressly disclose, wherein said set of vertices

includes reservoir vertices and well vertices. However, *Farmer* teaches, Figures 1-13d2 and Col.

7 lines 7-18.

*Claim interpretation*; the term *extremum path* is being interpreted to mean a subpath that is a shortest path, see page 7 of *Wayne*.

**4.13**    As regards claim 16, *Wayne* teaches, further including associating with each vertex on said each extremum path the identity of the predecessor vertex or the predecessor edge on said extremum path, see page 6.

**4.14**    As regards claim 17, *Wayne* teaches, further including associating with each vertex on each said extremum path the cost of the predecessor edge connected to said vertex on said extremum path, see page 6.

**4.15**    As regards claim 18, *Wayne* teaches, wherein said at least one source vertex includes a plurality of source vertices and further including iterating steps (d) and (e) for each of said plurality of source vertices to determine a plurality of collections of source vertex extrema paths for each said source vertex to a plurality of destination vertices (pages 6 & 7).

**4.16**    As regards claim 19, *Wayne* does not expressly disclose, wherein said plurality of source vertices includes well vertices. However, *Farmer* teaches well vertices/cells, see Col. 24 lines 30-67 and Col. 25 which teaches a simulation of a well reservoir.

**4.17**    As regards claim 20, *Wayne* teaches, further comprising selecting at least one reservoir vertex that is a destination vertex and determining the set of extrema paths from each source well vertex to said destination reservoir vertex (pages 3 & 4), however, *Wayne* does not expressly disclose a reservoir and well. *Farmer* discloses a reservoir and well, see Col. 24 lines 30-67 and Col. 25 which teaches a simulation of a well reservoir.

**4.18**    As regards claim 21, *Wayne* teaches, further comprising determining the most extreme extremum path of said set of extrema paths (pages 5-7).

**4.19**     As regards claim 22, *Wayne* teaches comprising selecting a first source well vertex from said plurality of source vertices and a second well vertex and determining the extremum path from said first source well vertex to said second well vertex, (pages 5-7).

**4.20**     As regards claim 23, *Wayne* teaches selecting an extremum path cost criterion, and determining a first destination vertex group comprising all destination vertices that are connected to said source vertex by extrema paths that meet said extremum path cost criterion, see page 6.

**4.21**     As regards claim 24, *Wayne* teaches, associating with each destination vertex within said first destination vertex group a value representative of the amount of a fluid contained within each said destination vertex and summing the total amount of fluid contained in said first destination vertex group (pages 5-7, see also page 2).

**4.22**     As regards claim 25, *Wayne* teaches, wherein said plurality of source vertices include vertices selected randomly and further including randomly selecting extrema paths from each of said randomly selected source vertices and displaying said randomly selected extrema paths on a 3D viewer (pages 5-7, see also page 2). However, *Wayne* does not expressly disclose, a 3D viewer, *Farmer* discloses a 3D viewer (Figure 13c2 item 40c1N).

**4.23**     As regards claim 26, *Wayne* teaches, wherein said plurality of collections of source vertex extrema paths contains at least two different extrema paths that have at least one common vertex and further comprising segregating the extrema paths from said plurality of collections of source vertex extrema paths into two or more groups, each of said groups comprising only paths that have no common vertices (pages 5-7 and page 2).

**4.24**    As regards claim 27, *Wayne* teaches, f) sorting said plurality of source vertex extrema paths according to said paths' relative summed costs; and (g) creating a display of said plurality of source vertex extrema paths' sorted relative summed costs (see page 8).

**4.25**    As regards claim 28, *Wayne* teaches, further including calculating the sample cumulative distribution function of path cost for said plurality of source vertex extrema paths and wherein said creating step (g) includes creating a display of said sample cumulative distribution function (pages 1-8).

**4.26**    As regards claim 29, *Wayne* teaches, wherein said single-source, shortest-paths algorithm contains a priority queue, implemented using a recursive formulation (see pages 1-8).

**4.27**    As regards claim 30, *Wayne* teaches wherein said single-source, shortest-paths algorithm contains a priority queue, implemented using an iterative formulation (see pages 1-8).

**4.28**    As regards claim 31, *Wayne* does not expressly disclose, wherein said method is completed using a computer, however, *Farmer* teaches Figure 14a.

**4.29**    As regards claims 34-41 see the rejections above.

## *Conclusion*

**5.**    Any inquiry concerning this communication or earlier communications from the examiner should be directed to DWIN M. CRAIG whose telephone number is (571)272-3710. The examiner can normally be reached on 10:00 - 6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

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like assistance from a USPTO Customer Service Representative or access to the automated

information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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